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# PATENT ABSTRACTS OF JAPAN

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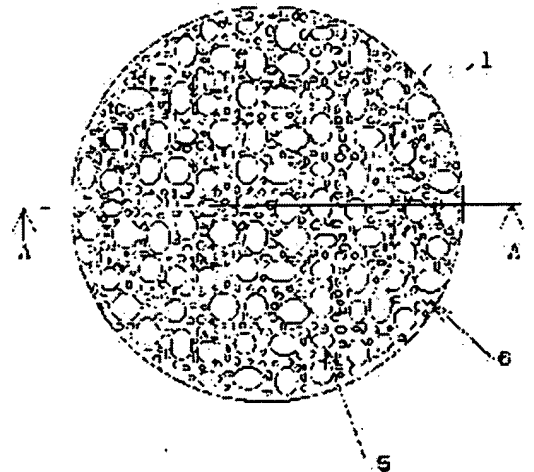
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## (54) POLISHING PAD

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a polishing pad where fluctuation in polishing speed and accuracy is small even if the thickness of the polishing pad is reduced by dressing.

**SOLUTION:** This polishing pad is used for polishing a surface, particularly, for flattening a semiconductor wafer or forming wiring, and consists of a macromolecular porous body. In this case, the polishing surface has at least one independent bubble per cm<sup>2</sup> with an average hole diameter of 0.3 mm or more, and at least 100 independent bubbles per cm<sup>2</sup> with an average hole diameter of 0.1 mm or less.



## LEGAL STATUS

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the scouring pad used for the approach (henceforth the CMP method) of grinding with the combination of the mechanical operation used for surface polish, especially flattening of a semi-conductor wafer and wiring formation, and a chemical operation.

[0002]

[Description of the Prior Art] It is increasingly performed with multilayering according [ a semi-conductor wafer ] to the densification of the accumulation consistency that it is becoming important to finish a front face evenly and it grinds the front face of a semi-conductor wafer by the CMP method for the reason. This approach grinds with a scouring pad, supplying the slurry which consists of an abrasive material and a chemical entity to the front face of a semi-conductor wafer.

[0003] As a scouring pad used for this polish, what infiltrated polyurethane resin into the nonwoven fabric, and the thing which consists of foaming polyurethane resin etc. are common. Generally the field of the side which grinds the semi-conductor wafer of these scouring pads is hard, and the thing before and behind 55 is used by Shore D specification as a degree of hardness.

[0004] Moreover, although the silica slurry which made water usually distribute a particle-like silica is used in a polish process, in order to supply a slurry to a pad front face at homogeneity, processing is carried out to the pad front face. For example, he forms a hole 2 in the front face of foaming polyurethane, and is trying to hold a slurry, as generally shown in drawing 3 and drawing 4 . As this hole 2, the hole 2 of 1.5mm of diameters continues all over a scouring pad at intervals of 5mm, and is formed, for example. This hole 2 is formed by punching processing etc. after fabricating foaming polyurethane. Moreover, in order to make supply of an abrasive material smooth, establishing the slots 3, such as the shape of the shape of a grid, a radial, and a concentric circle and a curled form, in the front face of foaming polyurethane, as shown in drawing 5 and drawing 6 is also performed. As for this slot 3, preparing by cutting etc. is [ after fabricating urethane foam ] common.

[0005]

[Problem(s) to be Solved by the Invention] By punching processing or cutting, a hole 2 or a slot 3 is formed by post processing after shaping of urethane foam. if magnitude of a scouring pad will be set to 600mmphi supposing it prepares the hole of 1.5mm of diameters at intervals of 5mm like for example, the above-mentioned example -- a hole - a number amounts to hundreds of or more places, and processing needs big costs and time amount. Moreover, dressing to which a scouring pad is called a dressing as a cure of the fall of the polish rate by the loading accompanying polish or the polish precision fall by wear [ un-homogeneity / front face / pad ] is performed. While it is effective in a new polished surface appearing in a scouring pad front face with the dressing, and being able to regain polish precision and a polish rate, the thickness of a scouring pad decreases along with a dressing, therefore the depth of a hole 2 or a slot 3 decreases. If the depth decreases, since the amount of the abrasive material held in the hole 2 and slot 3 will change, the polish rate of a semi-conductor wafer and polish precision change, and cause variation in polish quality. This invention was made in view of this actual condition, and even if the thickness of a scouring pad decreases with a dressing, it aims at offering a scouring pad with little variation in a polish rate or polish precision.

[0006]

[Means for Solving the Problem] That is, this invention is a scouring pad used for surface polish, especially flattening of a semi-conductor wafer and wiring formation, and it consists of a macromolecule porous body and is related with the scouring pad with which the polished surface is characterized by coming to have the closed cell of an average aperture 0.3mm or more the closed cell of 2 or more [ per piece/cm ], and an average aperture 0.1mm or less two or more [ 100 //cm ].

[0007]

[Embodiment of the Invention] When the macromolecule porous body concerning this invention contains closed cell 5 big group of an aperture, and closed cell 6 small group of an aperture in homogeneity as shown in drawing 1 and drawing 2 (refer to drawing 1 and drawing 2 ), and the cutting plane is observed, The thing of a 0.5-2mm average aperture preferably the big closed cell of an aperture 0.3mm or more Two or more [ per piece/cm ] It is desirable, the closed cell with 2 and an aperture small 2-5 pieces/cm is desirable 0.1mm or less, and the thing of a 0.01-0.08mm average aperture comes to have 300-800-piece [/cm ] 2 preferably two or more [ 100 //cm ]. By less than 0.3mm, the supply function to the whole field of an abrasive material falls [ the big diameter of a closed cell of an aperture ], and a polish rate becomes slow. Moreover, if the small diameter of a closed cell of an aperture exceeds 0.1mm, since the local maintenance capacity of an abrasive material will decline and a polish rate will become slow, it is not desirable.

[0008] As the quality of the material of the macromolecule porous body concerning this invention, although there is especially no limit, its thermosetting resin with a small creep property is desirable. If they are illustrated, an epoxy resin, polyester resin, polyurethane resin, JISHIKURO \*\* NTAJEN resin, phenol resin, a urea resin, melamine resin, etc. will be mentioned. Also in these, polyurethane resin is excellent in abrasion resistance, and desirable. Although it is possible also by using the foaming agent with which particle size differs as a means used as the closed cell object with which apertures differ, the big closed cell of an aperture and the small closed cell of an aperture can consider as the macromolecule porous body distributed to homogeneity by making the plastics empty capsid of a minor diameter mix and foam to the thermosetting resin which blended the foaming agent.

[0009] as a foaming agent -- chemistry foaming agents, water, etc., such as a bicarbonate, an azo system compound, a hydrazine compound, a semi cull BAZOJIDO compound, an azide compound, a triazole compound, and a nitroso compound, -- it can use -- these -- the base resin 100 weight section -- receiving -- \*\*\*\* for 0.1 - 2 weight sections -- the porous body which has about 1.5 to 2-time expansion ratio by things is obtained. As a plastics empty capsid, the particle which consists of acrylic resin, an acrylic nitril-vinylidene-chloride copolymer, phenol resin, etc. can be used. The empty capsid which consists of an acrylic nitril-vinylidene-chloride copolymer also in these can be preferably used from the point that a configuration will be able to adjust particle size to a true ball soon. as the loadings of this empty capsid -- the base resin 100 weight section -- receiving -- 0.5 - 5 weight section -- 1-3 weight section combination is carried out preferably.

[0010] The scouring pad concerning this invention is a macromolecule porous body which has the closed cell group from which an aperture differs, since the hole of a new major diameter appears one after another even if the thickness of a scouring pad decreases by wear, since the big closed cell of an aperture and the small closed cell of an aperture are distributed over homogeneity, it is necessary to prepare neither a hole nor a slot specially like the conventional scouring pad, and the variation in the polish rate of a semi-conductor wafer and polish precision is improved.

[0011]

[Example] Based on an example, the mode of operation of this invention is explained below.

After carrying out indirect desulfurization mind mixing of the ingredient shown in example 1 table 1 in a vacuum housing for 10 minutes, filling up metal mold with a die temperature of 60 degrees C and obtaining mold goods with a thickness of 10mm, it heat-treated in the thermostat for 60 minutes, and was made to harden completely at 80 degrees C. It sliced in 2mm thickness after that, and considered as the scouring pad. The specification of the scouring pad obtained in Table 2 is shown. Moreover, for the comparison, it was made from the urethane foam which used water for polyurethane resin as a foaming agent as a product of the conventional technique, and combined and carried out also about the case where there is a slot 3 as shown in drawing 5 and drawing 6 , and the case where there is no slot 3. The wrapping machine made from Japanese ENGISU (trade name: IMPTEC 10DVT) was equipped with the scouring pad shown in Table 2, for load 0.45MPa, rotational frequency 60rpm, and 2 minutes, fumed silica was contained 12% of the weight, and the polish trial of the silicon thermal oxidation film formed in the silicon wafer using the silica slurry of pH11 was performed on condition that the dressing. The obtained result is shown in Table 3.

[0012]

[Table 1]

表1

	品 名	メーカ	実施例	比較例 1.2
樹 脂	ポリオール	エッチ・アンド・ケー (株)	100	100
	ポリイソシアネート		100	100
発泡剤	水	——	0.1	0.2
粒 子	アクリル中空粒子	松本油脂(株)	5	(無し)
補助剤	シリコン整泡剤	東芝シリコン(株)	(無し)	1
	アミン系反応抑制剤	——	(無し)	0.1
	ワックス系離型剤	中京油脂(株)	(型へ塗布)	(型へ塗布)

Polyol: High cast N4014A (trade name)

Poly ISOSOANE-TO: High cast N4014B (trade name)

Empty capsid: Microsphere F-80 (trade name)

[0013]

[Table 2]

表2

項 目		単 位	実施例	比 較 例	
				比較例 1	比較例 2
溝の有無と仕様	巾	mm	(無し)	(無し)	0.5
	深さ	mm	(無し)	(無し)	1
	ピッチ	mm	(無し)	(無し)	5
成形品密度		g/cm <sup>3</sup>	0.85	0.85	0.85
ショア硬度		D	56	55	55
平均孔径		μΦ	小孔径 60 大孔径 430	50	50
平均孔数		個/cm <sup>2</sup>	小孔径 300 大孔径 2	300	300

[0014]

[Table 3]

表3

項 目	ドレッシング 回数(注)	単 位	実施例	従来技術 (比較用)	
				比較用 1	比較用 2
研磨速度	初期	nm/分	130	85	103
	200	nm/分	125	75	100
	400	nm/分	132	66	95
	600	nm/分	128	56	88

(注) : ウェハーの研磨1分/枚毎に、ドレッシング1分/回を実施した。

[0015]

[Effect of the Invention] Even if the thickness of a scouring pad decreased with the dressing, according to this invention, it became possible to offer a scouring pad with little variation in a polish rate or polish precision, so that clearly from the result shown in Table 3.

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CLAIMS

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[Claim(s)]

[Claim 1] The scouring pad characterized by being the scouring pad used for the surface polish on the front face of a body, consisting of a macromolecule porous body, and the polished surface coming to have the closed cell of an average aperture 0.3mm or more the closed cell of 2 or more [ per piece/cm ], and an average aperture 0.1mm or less two or more [ 100 //cm ].

[Claim 2] The scouring pad according to claim 1 with which a mean diameter serves as foam of the thermosetting resin with which a macromolecule porous body has the closed cell of an average aperture 0.3mm or more two or more [ per piece/cm ] from a plastics empty capsid 0.1mm or less.

[Claim 3] The scouring pad according to claim 1 or 2 whose plastics empty capsid the foam of thermosetting resin is polyurethane resin to which a chemistry foaming agent or water was made to foam as a foaming agent, and is an acrylonitrile-vinylidene-chloride copolymer.

[Claim 4] The scouring pad according to claim 1 to 3 whose scouring pad is what is used for flattening of a semiconductor wafer front face.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] The top view showing one example of this invention.

[Drawing 2] The A-A sectional view in drawing 2 .

[Drawing 3] The top view showing an example of the conventional scouring pad.

[Drawing 4] The B-B sectional view in drawing 3 .

[Drawing 5] The top view showing other examples of the conventional scouring pad.

[Drawing 6] C-C sectional view in drawing 5 (in drawing 3 -6, the configuration of the detailed hole which is produced in the case of urethane foam is omitted)

[Description of Notations]

1 Scouring Pad 2 Hole

3 Slot 4 Polished Surface

5 Major-Diameter Hole 6 Minor Diameter Hole

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[Translation done.]

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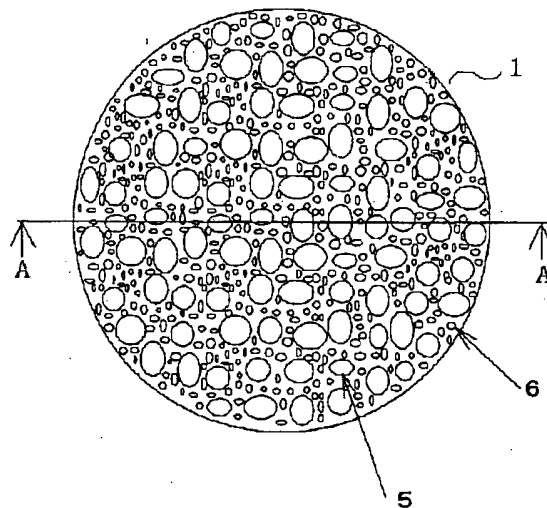
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(54) 【発明の名称】 研磨パッド

(57) 【要約】

【課題】 ドレッシングによって研磨パッドの厚さが減少しても研磨速度や研磨精度のバラツキの少ない研磨パッドを提供すること。

【解決手段】 表面研磨、特に半導体ウェハの平坦化や配線形成に用いる研磨パッドであって、高分子多孔質体よりなり、その研磨面が0.3 mm以上の平均孔径の独立気泡を1個/cm<sup>2</sup>以上、0.1 mm以下の平均孔径の独立気泡を100個/cm<sup>2</sup>以上有してなることを特徴とする。



## 【特許請求の範囲】

【請求項1】物体表面の表面研磨に用いる研磨パッドであって、高分子多孔質体よりなり、その研磨面が0.3 mm以上の平均孔径の独立気泡を1個/cm<sup>2</sup>以上、0.1 mm以下の平均孔径の独立気泡を100個/cm<sup>2</sup>以上有してなることを特徴とする研磨パッド。

【請求項2】高分子多孔質体が0.3 mm以上の平均孔径の独立気泡を1個/cm<sup>2</sup>以上有する熱硬化性樹脂の発泡体と、平均粒径が0.1 mm以下のプラスチック中空粒子とからなる請求項1記載の研磨パッド。

【請求項3】熱硬化性樹脂の発泡体が化学発泡剤または水を発泡剤として発泡させたポリウレタン樹脂であり、プラスチック中空粒子がアクリロニトリル-塩化ビニリデン共重合体である請求項1又は2記載の研磨パッド。

【請求項4】研磨パッドが半導体ウェハー表面の平坦化に用いるものである請求項1乃至3のいずれかに記載の研磨パッド。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、表面研磨、特に半導体ウェハーの平坦化や配線形成に用いる機械的な作用と化学的な作用との組み合わせにより研磨する方法(以下、CMP法という)に用いられる研磨パッドに関する。

## 【0002】

【従来の技術】半導体ウェハーは、その集積密度の高密度化による多層化に伴い、表面を平坦に仕上げることが重要になってきており、その為に半導体ウェハーの表面をCMP法で研磨することが行われるようになってきている。この方法は、半導体ウェハーの表面に研磨剤と化学成分からなるスラリーを供給しながら研磨パッドにより研磨を行うものである。

【0003】この研磨に用いられる研磨パッドとしては、不織布にポリウレタン樹脂を含浸させたものや、発泡ポリウレタン樹脂等からなるものが一般的である。これら研磨パッドの半導体ウェハーを研磨する側の面は一般に硬質であり、硬度としてはショアD規格で55前後のものが使用されている。

【0004】また、研磨プロセスでは通常微粒子状シリカを水に分散させたシリカスラリーを使用するが、スラリーをパッド表面に均一に供給するためにパッド表面には加工がされている。たとえば、一般的には図3、図4に示すように、発泡ポリウレタンの表面に孔2を形成しスラリーを保持するようにしている。この孔2としては、例えば、径1.5 mmの孔2が5 mm間隔で研磨パッドの全面に亘って形成されている。この孔2は発泡ポリウレタンを成形後、バンチング加工等によって設けられる。また、研磨剤の供給をスムーズにするために、図5、図6に示すように発泡ポリウレタンの表面に格子状あるいは放射状、同心円状、渦巻き状等の溝3を設ける

ことも行われている。この溝3は発泡ウレタンを成形後、切削加工等によって設けるのが一般的である。

## 【0005】

【発明が解決しようとする課題】孔2あるいは溝3はバンチング加工あるいは切削加工等によって、発泡ウレタンの成形後に後加工によって設けられる。例えば前述例のように径1.5 mmの孔を5 mm間隔で設けるとすると、仮に研磨パッドの大きさを600 mmφとすると孔数は数百ヶ所以上にのぼり、加工作業は大きな費用と時間を必要としている。また、研磨パッドは、研磨に伴う目づまりによる研磨速度の低下やパッド表面の非均一な摩耗による研磨精度低下の対策として、ドレッシングと呼ばれる目立てが行われる。そのドレッシングによって研磨パッド表面に新たな研磨面が現れ、研磨精度、研磨速度を取り戻すことができる効果がある反面、ドレッシングにつれて研磨パッドの厚さは減少し、従って孔2や溝3の深さは減少する。深さが減少すると、その孔2や溝3に保持される研磨剤の量が変化するため、半導体ウェハーの研磨速度、研磨精度は変化し、研磨品質のバラツキの原因となる。本発明はかかる実状に鑑みなされたもので、ドレッシングによって研磨パッドの厚さが減少しても研磨速度や研磨精度のバラツキの少ない研磨パッドを提供することを目的とする。

## 【0006】

【課題を解決するための手段】即ち、本発明は、表面研磨、特に半導体ウェハーの平坦化や配線形成に用いる研磨パッドであって、高分子多孔質体よりなり、その研磨面が0.3 mm以上の平均孔径の独立気泡を1個/cm<sup>2</sup>以上、0.1 mm以下の平均孔径の独立気泡を100個/cm<sup>2</sup>以上有してなることを特徴とする研磨パッドに関する。

## 【0007】

【発明の実施の形態】本発明にかかる高分子多孔質体は、図1及び図2に示すように孔径の大きな独立気泡5群と孔径の小さな独立気泡6群を均質に含んでおり(図1、図2参照)、その切断面を観測したとき、孔径の大きな独立気泡は0.3 mm以上好ましくは0.5~2 mmの平均孔径のものが1個/cm<sup>2</sup>以上、好ましくは2~5個/cm<sup>2</sup>、孔径の小さな独立気泡は0.1 mm以下好ましくは0.01~0.08 mmの平均孔径のものが100個/cm<sup>2</sup>以上、好ましくは300~800個/cm<sup>2</sup>有してなる。孔径の大きな独立気泡径が0.3 mm未満では、研磨剤の面全体への供給機能が低下し研磨速度が遅くなる。また、孔径の小さな独立気泡径が0.1 mmを超えると、研磨剤の局所的な保持能力が低下し研磨速度が遅くなるので好ましくない。

【0008】本発明にかかる高分子多孔質体の材質としては、特に制限はないがクリープ特性が小さい熱硬化性樹脂が好ましい。それらを例示すればエポキシ樹脂、ポリエステル樹脂、ポリウレタン樹脂、ジシクロペンタジ

エン樹脂、フェノール樹脂、ユリア樹脂、メラミン樹脂等が挙げられる。これらの中でもポリウレタン樹脂が耐摩耗性に優れており好ましい。孔径の異なる独立気泡体とする手段としては、粒径の異なる発泡剤を用いることによっても可能であるが、発泡剤を配合した熱硬化性樹脂に、小径のプラスチック中空粒子を混合し発泡させることにより、孔径の大きな独立気泡と孔径の小さな独立気泡が均一に分散した高分子多孔質体とすることができ

【0009】発泡剤としては、重炭酸塩、アゾ系化合物、ヒドラジン化合物、セミカルバゾジド化合物、アジド化合物、トリアゾール化合物、ニトロソ化合物等の化学発泡剤や水等を用いることができ、これらはベース樹脂100重量部に対し0.1～2重量部用いることによ

って1.5～2倍程度の発泡倍率を有する多孔質体が得られる。プラスチック中空粒子としては、アクリル樹脂、アクリルニトリル-塩化ビニリデン共重合体、フェノール樹脂等からなる粒子を用いることができる。これらの中でもアクリルニトリル-塩化ビニリデン共重合体からなる中空粒子は形状が真球に近く粒径を調整できる点から好ましく用いることができる。かかる中空粒子の配合量としてはベース樹脂100重量部に対し0.5～5重量部、好ましくは1～3重量部配合する。

【0010】本発明にかかる研磨パッドは、孔径の異なる独立気泡群を有する高分子多孔質体であり、孔径の大きな独立気泡及び孔径の小さな独立気泡が均一に分布している

ので、研磨パッドの厚さが磨耗によって減少して\*

表1

	品 名	メーカ	実施例	比較例1.2
樹 脂	ポリオール ポリイソシアネート	エッチ・アンド・ケー (株)	100	100
			100	100
発泡剤	水	—	0.1	0.2
粒 子	アクリル系中空粒子	松本油脂(株)	5	(無し)
補助剤	シリコン整泡剤	東芝シリコン(株)	(無し)	1
	アミン系反応抑制剤	—	(無し)	0.1
	ワックス系離型剤	中京油脂(株)	(型へ塗布)	(型へ塗布)

ポリオール：ハイキャストN4014A（商品名）

ポリイソシアネート：ハイキャストN4014B（商品名）

＊も、次々と新たな大径の孔が現れるので、従来の研磨パッドのように孔や溝をわざわざ設ける必要がなく半導体ウェハーの研磨速度、研磨精度のバラツキが改善される。

【0011】

【実施例】以下実施例に基づき本発明の実施の態様を説明する。

#### 実施例1

表1に示す材料を真空容器中で10分間脱気混合し、金型温度60℃の金型に充填し、厚さ10mmの成形品を得た後、80℃で60分間高温槽中で加熱処理し完全に硬化させた。その後2mm厚みにスライスし研磨パッドとした。表2に得られた研磨パッドの仕様を示す。また、比較の為に、従来技術の製品としてポリウレタン樹脂に発泡剤として水を用いた発泡ウレタンを材料とし、図5、図6に示すような溝3の有る場合と、溝3の無い場合についても併せ実施した。表2に示す研磨パッドを日本エンギス（株）製ラッピングマシン（商品名：1MPTEC 10DVT）に装着し、荷重0.45MPa、回転数60rpm、2分間研磨、2分間ドレッシングの条件で、ヒュームドシリカを12重量%含有し、pH11のシリカスラリーを使ってシリコンウェハに形成したシリコン熱酸化膜の研磨試験をおこなった。得られた結果を表3に示す。

【0012】

【表1】

中空粒子：マイクロスフェアF-80（商品名）

【0013】

【表2】

表2

項 目		単 位	実施例	比 較 例	
				比較例1	比較例2
溝の有無と仕様	巾	mm	(無し)	(無し)	0.5
	深さ	mm	(無し)	(無し)	1
	ピッチ	mm	(無し)	(無し)	5
成形品密度		g/cm <sup>3</sup>	0.85	0.85	0.85
ショア硬度		D	56	55	55
平均孔径		μΦ	小孔径 60 大孔径 430	50	50
平均孔数		個/cm <sup>2</sup>	小孔径 300 大孔径 2	300	300

【0014】

\* \* 【表3】

表3

項 目	ドレッシング 回数(注)	単 位	実施例	従来技術 (比較用)	
				比較用1	比較用2
研磨速度	初期	nm/分	130	85	103
	200	nm/分	125	75	100
	400	nm/分	132	66	95
	600	nm/分	128	56	88

(注)：ウェハの研磨1分/枚毎に、ドレッシング1分/回を実施した。

【0015】

【発明の効果】表3に示す結果から明らかなように、本発明によれば、ドレッシングによって研磨パッドの厚さが減少しても研磨速度や研磨精度のバラツキの少ない研磨パッドを提供することが可能となった。

【図面の簡単な説明】

【図1】本発明の一実施例を示す平面図。

【図2】図2におけるA-A断面図。

【図3】従来の研磨パッドの一例を示す平面図。

※【図4】図3におけるB-B断面図。

【図5】従来の研磨パッドの他の一例を示す平面図。

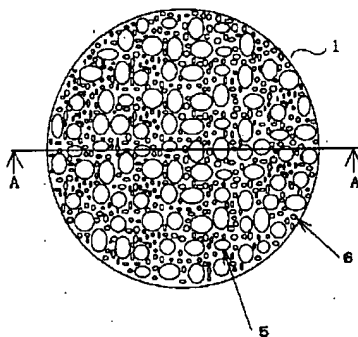
【図6】図5におけるC-C断面図（図3～6において、発泡ウレタンの場合生じる微細空孔の形状は省略）

【符号の説明】

- 1 研磨パッド      2 孔  
3 溝              4 研磨面  
5 大径孔          6 小径孔

※30

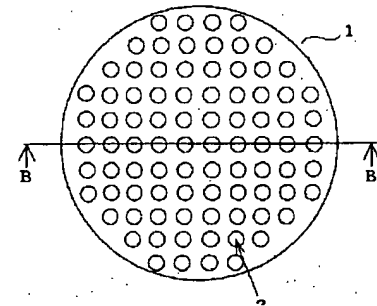
【図1】



【図2】



【図3】



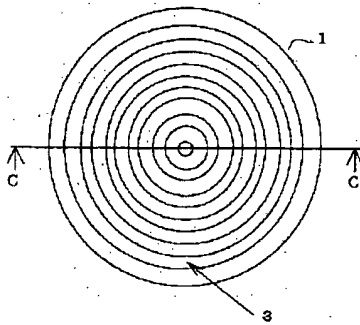
【図4】



【図6】



【図5】



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フロントページの続き

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AA64 AA65 AA78 BA03 BA13  
BA14 BA15 BA16 BA17 BA18  
BA20 CA23 DA02 DA03 DA12  
DA56

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the scouring pad used for the method (henceforth the CMP method) of grinding with the combination of the mechanical operation used for surface polishing, especially flattening of a semiconductor wafer and wiring formation, and a chemical operation.

[0002]

[Description of the Prior Art] It is increasingly performed with multilayering according [ a semiconductor wafer ] to the densification of the accumulation density that it is becoming important to finish the surface evenly and it grinds the surface of a semiconductor wafer by the CMP method for the reason. This method grinds with a scouring pad, supplying the slurry which consists of an abrasive material and a chemical entity to the surface of a semiconductor wafer.

[0003] As a scouring pad used for this polishing, what carried out impregnation of the polyurethane resin to the nonwoven fabric, and the thing which consists of foaming polyurethane resin etc. are common. Generally the field of the side which grinds the semiconductor wafer of these scouring pads is hard, and the thing before and behind 55 is used by Shore D specification as a degree of hardness.

[0004] Moreover, although the silica slurry which made water usually distribute a particle-like silica is used in a polishing process, in order to supply a slurry to the pad surface at homogeneity, processing is carried out to the pad surface. For example, he forms a hole 2 in the surface of foaming polyurethane, and is trying to hold a slurry, as generally shown in drawing 3 and drawing 4 . As this hole 2, the hole 2 of 1.5mm of diameters continues all over a scouring pad at intervals of 5mm, and is formed, for example. This hole 2 is formed by punching processing etc. after fabricating foaming polyurethane. Moreover, in order to make supply of an abrasive material smooth, establishing the slots 3, such as the shape of the shape of a grid, a radial, and a concentric circle and a curled form, in the surface of foaming polyurethane, as shown in drawing 5 and drawing 6 is also performed. As for this slot 3, preparing by cutting etc. is [ after fabricating urethane foam ] common.

[0005]

[Problem(s) to be Solved by the Invention] By punching processing or cutting, a hole 2 or a slot 3 is formed by post processing after shaping of urethane foam. if magnitude of a scouring pad will be set to 600mmphi supposing it prepares the hole of 1.5mm of diameters at intervals of 5mm like for example, the above-mentioned example -- a hole -- a number amounts to hundreds of or more places, and processing needs big costs and time amount. Moreover, dressing to which a scouring pad is called a dressing as a cure of the fall of the polishing speed by the loading accompanying polishing or the polishing precision fall by wear [ un-homogeneity / surface / pad ] is performed. While it is effective in a new polished surface appearing in the scouring pad surface with the dressing, and being able to regain polishing precision and polishing speed, the thickness of a scouring pad decreases along with a dressing, therefore the depth of a hole 2 or a slot 3 decreases. If the depth decreases, since the amount of the abrasive material held in the hole 2 and slot 3 will change, the polishing speed of a semiconductor wafer and polishing precision change, and cause variation in polishing quality. This invention was made in view of this actual condition, and even if the thickness of a scouring pad decreases with a dressing, it aims at offering a scouring pad with little variation in polishing speed or polishing precision.

[0006]

[Means for Solving the Problem] That is, this invention is a scouring pad used for surface polishing, especially flattening of a semiconductor wafer and wiring formation, and it consists of a macromolecule porosity object and is related with a scouring pad with which the polished surface is characterized by coming to have a closed cell of an average aperture 0.3mm or more a closed cell of 2 or more [ per piece/cm ], and an average aperture 0.1mm or less two or more [ 100 //cm ].

[0007]

[Embodiment of the Invention] When the macromolecule porosity object concerning this invention contains closed cell 5 big group of an aperture, and closed cell 6 small group of an aperture in homogeneity as shown in drawing 1 and drawing 2 (refer to drawing 1 and drawing 2 ), and the cutting plane is observed, The thing of a 0.5-2mm average aperture preferably the big closed cell of an aperture 0.3mm or more Two or more [ per piece/cm ] It is desirable, the closed cell with 2 and an aperture small 2-5 pieces/cm is desirable 0.1mm or less, and the thing of a 0.01-0.08mm average aperture comes to have 300-800-piece [/cm ] 2 preferably two or more [ 100 //cm ]. By less than 0.3mm, the supply function to the whole field of an abrasive material falls [ the big diameter of a closed cell of an aperture ], and polishing speed becomes slow. Moreover, if the small diameter of a closed cell of an aperture exceeds 0.1mm, since the local maintenance capacity of an abrasive material will decline and polishing speed will become slow, it is

not desirable.

[0008] As the quality of the material of the macromolecule porosity object concerning this invention, although there is especially no limit, its thermosetting resin with a small creep property is desirable. If they are illustrated, an epoxy resin, polyester resin, polyurethane resin, JISHIKURO \*\* NTAJEN resin, phenol resin, a urea resin, melamine resin, etc. will be mentioned. Also in these, polyurethane resin is excellent in abrasion resistance, and desirable. Although it is possible also by using the foaming agent with which particle size differs as a means used as the closed cell object with which apertures differ, the big closed cell of an aperture and the small closed cell of an aperture can consider as the macromolecule porosity object distributed to homogeneity by making the plastics empty capsid of a minor diameter mix and foam to the thermosetting resin which blended the foaming agent.

[0009] as a foaming agent -- chemistry foaming agents, water, etc., such as a bicarbonate, an azo system compound, a hydrazine compound, a semi cull BAZOJIDO compound, an azide compound, a triazole compound, and a nitroso compound, -- it can use -- these -- the base resin 100 weight section -- receiving -- \*\*\*\* for 0.1 - 2 weight sections -- the porosity object which has about 1.5 to 2-time expansion ratio by things is acquired. As a plastics empty capsid, the particle which consists of acrylic resin, an acrylic nitril-vinylidene-chloride copolymer, phenol resin, etc. can be used. The empty capsid which consists of an acrylic nitril-vinylidene-chloride copolymer also in these can be preferably used from the point that a configuration will be able to adjust particle size to a true ball soon. as the loadings of this empty capsid -- the base resin 100 weight section -- receiving -- 0.5 - 5 weight section -- 1-3 weight section combination is carried out preferably.

[0010] The scouring pad concerning this invention is a macromolecule porosity object which has the closed cell group from which an aperture differs, since the hole of a new major diameter appears one after another even if the thickness of a scouring pad decreases by wear, since the big closed cell of an aperture and the small closed cell of an aperture are distributed over homogeneity, it is necessary to prepare neither a hole nor a slot specially like the conventional scouring pad, and the variation in the polishing speed of a semiconductor wafer and polishing precision is improved.

[0011]

[Example] Based on an example, the mode of operation of this invention is explained below.

After carrying out indirect desulfurization mind mixing of the material shown in example 1 table 1 in a vacuum housing for 10 minutes, filling up metal mold with a die temperature of 60 degrees C and obtaining mold goods with a thickness of 10mm, it heat-treated in the thermostat for 60 minutes, and was made to harden completely at 80 degrees C. It sliced in 2mm thickness after that, and considered as the scouring pad. The specification of the scouring pad obtained by the table 2 is shown. Moreover, for the comparison, it was made from the urethane foam which used water for polyurethane resin as a foaming agent as a product of the conventional technology, and combined and carried out also about the case where there is a slot 3 as shown in drawing 5 and drawing 6, and the case where there is no slot 3. The wrapping machine made from Japanese ENGISU (trade name: IMPTEC 10DVT) was equipped with the scouring pad shown in a table 2, for load 0.45MPa, rotational frequency 60rpm, and 2 minutes, for polishing and 2 minutes, fumed silica was contained 12% of the weight, and the polishing trial of the silicon thermal oxidation film formed in the silicon wafer using the silica slurry of pH11 was performed on condition that the dressing. The obtained result is shown in a table 3.

[0012]

[A table 1]

表1

	品 名	メーカ	実施例	比較例 1.2
樹 脂	ポリオール	エッチ・アンド・ケー (株)	100	100
	ポリイソシアネート		100	100
発泡剤	水	――	0. 1	0. 2
粒 子	アクリル中空粒子	松本油脂(株)	5	(無し)
補助剤	シリコン整泡剤	東芝シリコン(株)	(無し)	1
	アミン系反応抑制剤	――	(無し)	0. 1
	ワックス系離型剤	中京油脂(株)	(型へ塗布)	(型へ塗布)

Polyol: High cast N4014A (trade name)

Poly ISOSOANE-TO: High cast N4014B (trade name)

Empty capsid: Microsphere F-80 (trade name)

[0013]

[A table 2]



表2

項 目		単 位	実施例	比 較 例	
				比較例 1	比較例 2
溝の有無と仕様	巾	mm	(無し)	(無し)	0.5
	深さ	mm	(無し)	(無し)	1
	ピッチ	mm	(無し)	(無し)	5
成形品密度		g/cm <sup>3</sup>	0.85	0.85	0.85
ショア硬度		D	56	55	55
平均孔径		$\mu\Phi$	小孔径 60	50	50
			大孔径 430	—	—
平均孔数		個/cm <sup>2</sup>	小孔径 300	300	300
			大孔径 2	—	—

[0014]

[A table 3]

表3

項 目	ドレッシング 回数 (注)	単 位	実施例	従来技術 (比較用)	
				比較用 1	比較用 2
研磨速度	初期	nm/分	130	85	103
	200	nm/分	125	75	100
	400	nm/分	132	66	95
	600	nm/分	128	56	88

(注) : ウェハーの研磨1分/枚毎に、ドレッシング1分/回を実施した。

[0015]

[Effect of the Invention] Even if the thickness of a scouring pad decreased with the dressing, according to this invention, it became possible to offer a scouring pad with little variation in polishing speed or polishing precision, so that clearly from the result shown in a table 3.

[Translation done.]

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**DESCRIPTION OF DRAWINGS**

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[Brief Description of the Drawings]

[Drawing 1] The plan showing one example of this invention.

[Drawing 2] The A-A cross section in drawing 2 .

[Drawing 3] The plan showing an example of the conventional scouring pad.

[Drawing 4] The B-B cross section in drawing 3 .

[Drawing 5] The plan showing other examples of the conventional scouring pad.

[Drawing 6] C-C cross section in drawing 5 (in drawing 3 -6, the configuration of the detailed hole which is produced in the case of urethane foam is omitted)

[Description of Notations]

1 Scouring Pad 2 Hole

3 Slot 4 Polished Surface

5 Major-Diameter Hole 6 Minor Diameter Hole

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[Translation done.]

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**CLAIMS**

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[Claim(s)]

[Claim 1] A scouring pad characterized by being the scouring pad used for surface polishing on the surface of a body, consisting of a macromolecule porosity object, and the polished surface coming to have a closed cell of an average aperture 0.3mm or more a closed cell of 2 or more [ per piece/cm ], and an average aperture 0.1mm or less two or more [ 100 //cm ].

[Claim 2] A scouring pad according to claim 1 with which mean particle diameter serves as foam of thermosetting resin with which a macromolecule porosity object has a closed cell of an average aperture 0.3mm or more two or more [ per piece/cm ] from a plastics empty capsid 0.1mm or less.

[Claim 3] A scouring pad according to claim 1 or 2 whose plastics empty capsid foam of thermosetting resin is polyurethane resin to which a chemistry foaming agent or water was made to foam as a foaming agent, and is an acrylonitrile-vinylidene-chloride copolymer.

[Claim 4] A scouring pad according to claim 1 to 3 whose scouring pad is what is used for flattening of the semiconductor wafer surface.

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[Translation done.]

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